



The Late Miocene climate response to global vegetation change

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The Late Miocene belongs to the late phase of the Cenozoic climate cooling, but proxy data indicate that it was still a generally warm and humid episode as compared to today. Corresponding to the overall warm and humid conditions, there were generally more forests and less desert in the Miocene. Especially northern high latitudes were warmer than at present and palaeovegetation was characterised rather more by boreal forests than tundra like today. The vegetation change from the Miocene to present was a result of the overall climate cooling, but based on a climate modelling sensitivity experiment we demonstrate that vegetation changes also contributed to Cenozoic climate cooling. We perform two experiments using the atmosphere-ocean general circulation model COSMOS with the physical boundary conditions representing the Late Miocene. For instance, the model runs consider a lower elevation of the Tibetan Plateau, an open Central American Isthmus and the Paratethys. In order to address the Miocene-to-present vegetation change, one experiment includes the modern vegetation while the other one uses the palaeovegetation. The global temperature of the experiment using the modern vegetation is by 1.6 °C lower than using the palaeovegetation. This is in the same order of magnitude as moderate future climate change projections, if one considers that the sign needs to be reversed. From our sensitivity experiment, we observe that particularly high latitudes get cooler because of replacing boreal forests with modern tundra vegetation. The albedo effect is relevant to understand how the vegetation change from the Miocene to present in the high latitudes contributes to the climate cooling trend. Our results emphasise that the role of vegetation is important to understand past climates.